Detection of Anti-patterns in Mobile Applications

Geoffrey Hecht, Laurence Duchien, Naouel Moha, Romain Rouvoy

Detection of Anti-patterns in Mobile Applications

Geoffrey Hecht <geoffrey.hecht@inria.fr>, Laurence Duchien <laurence.duchien@inria.fr>, Naouel Moha <moha.naouel@uqam.ca>, Romain Rouvoy <romain.rouvoy@inria.fr>

Motivations

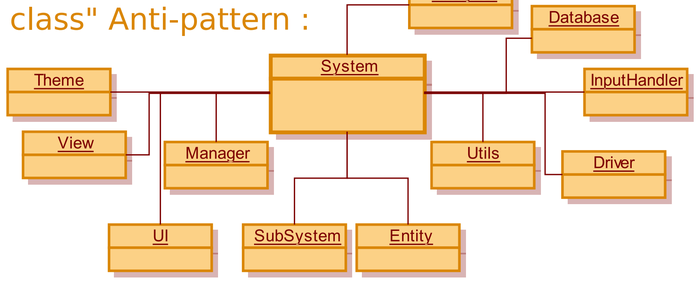
Lack of studies on Android Anti-patterns :

- Influence of the framework on common anti-patterns,
- Android specific anti-patterns,
- Patterns related to applications categories,
- Correlation with application ratings ,
- Evolution along updates ?

Anti-Patterns

- Bad solutions to solve problems
- Hard to maintain and update
- Source of bugs

"God class" Anti-pattern :



Metrics

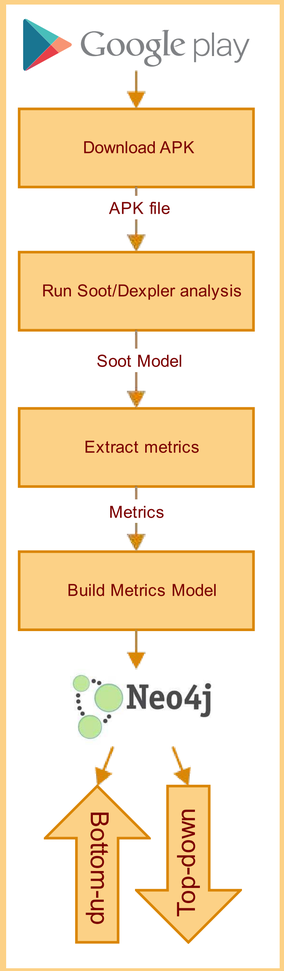
Main metrics :

- Lines of Code
- Cohesion of a class
- Coupling between classes
- Cyclomatic complexity
- Depth of Inheritance

Anti-patterns = Combination of metrics

"God class" = low cohesion, numerous lines of code, a high coupling

Application Analysis

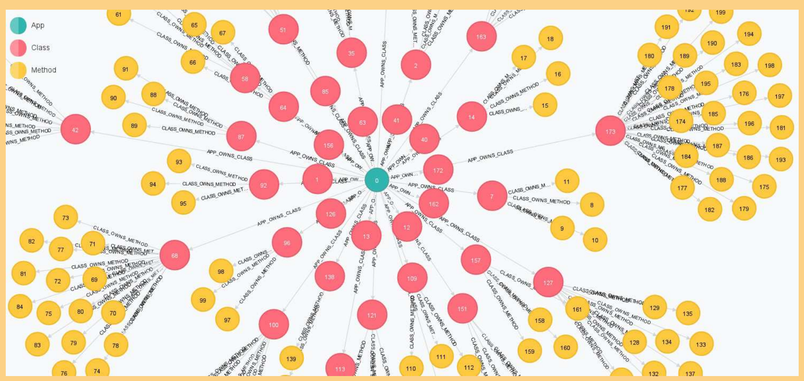


Analysis on **Android package**

Analyze of **binary code** with Soot and dexpler submodule

Metrics are extracted from Soot model to build a new one

This model is then stored in a **graph database**



Nodes = app, method or class
Edges = relation
Properties = metrics

Anti-Patterns Detection

Study on **3500+ apps** with an average of 7 versions

Top-down

Top-down approach : Common anti-patterns with **thresholds** on metrics

Bottom-up

Bottom-up approach : **Machine-learning** algorithms to detect new anti-patterns

Anti-Patterns Fixing

- Increase maintainability and understandability
- Reduce energy consumption
- Improve responsiveness
- Decrease package size
- Less bugs

References

- Bartel, Alexandre, et al. "Dexpler: converting android dalvik bytecode to jimple for static analysis with soot." Proceedings of the ACM SIGPLAN International Workshop on State of the Art in Java Program analysis. ACM, 2012.
- Linares-Vásquez, Mario, et al. "Domain matters: bringing further evidence of the relationships among anti-patterns, application domains, and quality-related metrics in Java mobile apps." Proceedings of the 22nd International Conference on Program Comprehension. ACM, 2014.
- Minelli, Roberto, and Michele Lanza. "Software Analytics for Mobile Applications--Insights and Lessons Learned." Software Maintenance and Reengineering (CSMR), 2013 17th European Conference on. IEEE, 2013.
- Shabtai, Asaf, Yuval Fledel, and Yuval Elovici. "Automated static code analysis for classifying Android applications using machine learning." Computational Intelligence and Security (CIS), 2010 International Conference on. IEEE, 2010.